Claims

1. A method for modulating sub-carrier symbols F(k) to an intermediate-frequency OFDM signal (f(n)) having even and odd samples, the method comprising the steps of:
- transforming a number N of the sub-carrier symbols F(k) to pre-processed sub-carrier symbols Z(k);
- performing a complex inverse discrete Fourier transformation (IDFT) on the pre-processed sub-carrier symbols Z(k) to generate complex output symbols z(n); and
- transforming the complex output symbols z(n) to the intermediate-frequency OFDM signal (f(n)),
wherein the sub-carrier symbols F(k) are transformed so that the even and odd samples of the intermediate-frequency OFDM signal (f(n)) are given by real and imaginary parts of the complex output symbols z(n).

2. Method according to claim 1, wherein the step of transforming a number N of the sub-carrier symbols F(k) to pre-processed sub-carrier symbols Z(k) is performed according to the function:

$$Z(k)=\frac{1}{2}\cdot\left[F(k)+F(N-k)^{*}\right]+\frac{1}{2}\cdot j\cdot\left[F(k)-F(N-k)^{*}\right]\cdot e^{+j\pi k/N}$$

with k=0…N-1.

3. Method according to claim 1 or 2 further comprising the steps of:
- assigning the sub-carrier symbols F(k) to a spectrum F(i) with i=0…2N-1 of the intermediate-frequency OFDM signal (f(n)), negative frequency contents being derivable from the symmetry property of spectra of real sequences, $F(i)=F(2N-i)^{*}$;
- converting the sub-carrier symbols F(k), with k=0…N-1, to the pre-processed complex sub-carrier symbols Z(k)

using the symmetry property of spectra of real sequences, wherein Z(k)=X(k)+j*Y(k) with X(k) and Y(k) defining the spectra of real sequences x(n) and y(n); and
- performing the complex inverse discrete Fourier transformation(IDFT) of the pre-processed complex sub-carrier symbols Z(k) into the complex output symbols z(n) = x(n)+j*y(n).

4. Method according to any preceding claim, wherein the complex inverse discrete Fourier transformation (IDFT) is performed as an inverse fast Fourier transformation (IFFT).

5. Method according to one of the claims 1 to 4, wherein the transforming of the sub-carrier symbols F(k) is performed by multiplexing the real and imaginary parts of the complex output symbols z(n) into even and odd samples of the intermediate-frequency OFDM signal (f(n)).

6. A method for demodulating an intermediate-frequency OFDM signal (f(n)) having even and odd samples to post-processed sub-carrier symbols F(k), the method comprising the steps of:
- transforming the intermediate-frequency OFDM signal (f(n)) to complex input symbols z(n), the even and odd samples being associated with real and imaginary parts of the complex input symbols z(n);
- performing a complex discrete Fourier transformation (DFT) on the complex input symbols z(n) to generate complex DFT output symbols Z(k); and
- transforming the complex DFT output symbols Z(k) to the post-processed sub-carrier symbols F(k).

7. Method according to claim 6, wherein transforming the complex DFT output symbols Z(k) to the post-processed sub-carrier symbols F(k) is performed according to the function:

$$F(k) = \frac{1}{2} \cdot \left[Z(k) + Z(N-k)^{*}\right] - \frac{1}{2} \cdot j \cdot \left[Z(k) - Z(N-k)^{*}\right] \cdot e^{-j\pi k/N}$$

with k=0...N-1.

8. Method according to claim 6 or 7, wherein the complex discrete Fourier transformation (DFT) is performed as a fast Fourier transformation (FFT).

9. Method according to one of the claims 6 to 8 further comprising de-multiplexing the even and odd samples of the intermediate-frequency OFDM signal (f(n)) onto the real and imaginary parts of the complex input symbols z(n)=x(n)+j*y(n) with x(n)=f(2n) and y(n)=f(2n+1) with n=0...N-1.

10. Method according to one of the claims 6 to 9, further comprising the steps of:
- performing the complex discrete Fourier transformation (DFT) of the complex input symbols z(n) into the complex DFT output symbols Z(k)=X(k)+j*Y(k) with k=0...N-1, X(k) and Y(k) being the spectra of the real sequences x(n) and y(n);
- post-processing of the complex DFT output symbols Z(k) with k=1...N-1 to the post-processed sub-carrier symbols F(k)= X(k)+ $e^{-j\pi k/N}$·Y(k) of the intermediate-frequency OFDM signal (f(n)); and
- assigning the post-processed sub-carrier symbols F(k) to an order for further processing.

11. A computer program element comprising program code means for performing the method of any one of the claims 1 to 10 when said program is run on a computer.

12. A computer program product stored on a computer usable medium, comprising computer readable program means for causing a computer to perform the method according to any one of the claims 1 to 10.

13. An orthogonal frequency division multiplex modulator (1) for modulating sub-carrier symbols F(k) to an intermediate-frequency OFDM signal (f(n)) having even and odd samples, the modulator comprising:
- first transforming means (10) for transforming a number N of the sub-carrier symbols F(k) to pre-processed sub-carrier symbols Z(k);
- IDFT means (4) for performing a complex inverse discrete Fourier transformation (IDFT) on the pre-processed sub-carrier symbols Z(k) to generate complex output symbols z(n); and
- second transforming means (50) for transforming the complex output symbols z(n) to the intermediate-frequency OFDM signal (f(n)),
wherein the sub-carrier symbols F(k) are transformable in the second transforming means (50) so that the even and odd samples of the intermediate-frequency OFDM signal (f(n)) are given by real and imaginary parts of the complex output symbols z(n).

14. Orthogonal frequency division multiplex modulator (1) according to claim 13, wherein the first transforming means (10) for transforming of the sub-carrier symbols F(k) to pre-processed sub-carrier symbols Z(k) is adapted to perform the function:

$$Z(k)=\frac{1}{2}\cdot\left[F(k)+F(N-k)^{*}\right]+\frac{1}{2}\cdot j\cdot\left[F(k)-F(N-k)^{*}\right]\cdot e^{+j\pi k/N}$$

with k=0…N-1.

15. Orthogonal frequency division multiplex modulator (1) according to claim 13 or 14, wherein the IDFT means (4) exhibits the functionality to perform an inverse fast Fourier transformation (IFFT).

16. Orthogonal frequency division multiplex modulator (1) according to one of the claims 13 to 15, wherein the first transforming means (10) further comprises:
- assigning means (10a) for assigning the sub-carrier symbols F(k) to a spectrum F(i) with i=0…2N-1 of the intermediate-frequency OFDM signal (f(n)), negative frequency contents being derivable from the symmetry property of spectra of real sequences, $F(i)=F(2N-i)^{*}$;
- converter means (10b) for converting the sub-carrier symbols F(k), with k=0…N-1, to the pre-processed complex sub-carrier symbols Z(k) using the symmetry property of spectra of real sequences, where Z(k)=X(k)+j*Y(k) with X(k) and Y(k) defining the spectra of real sequences x(n) and y(n).

17. Orthogonal frequency division multiplex modulator (1) according to one of the claims 13 to 16, wherein the IDFT means (4) is adapted to perform the complex inverse discrete Fourier transformation (IDFT) of the pre-processed complex sub-carrier symbols Z(k) into the complex output symbols z(n) = x(n)+j*y(n).

18. Orthogonal frequency division multiplex modulator (1) according to one of the claims 13 to 17, wherein the second transforming means (50) comprises a multiplexing

means (52) for multiplexing of the real and imaginary parts of the complex output symbols z(n) into even and odd samples of the intermediate-frequency OFDM signal (f(n)).

19. Orthogonal frequency division multiplex modulator (1) according to one of the claims 13 to 18, wherein the first transforming means (10) and the IDFT means (4) are integrated in one device.

20. An orthogonal frequency division multiplex demodulator (2) for demodulating an intermediate-frequency OFDM signal (f(n)) having even and odd samples to post-processed sub-carrier symbols F(k), the demodulator comprising:
- third transforming means (13) for transforming the intermediate-frequency OFDM signal (f(n)) to complex input symbols z(n), the even and odd samples being associated with real and imaginary parts of the complex input symbols z(n);
- DFT means (14) for performing a complex discrete Fourier transformation on the complex input symbols z(n) to generate complex DFT output symbols Z(k);
- fourth transforming means (15) for transforming the complex DFT output symbols Z(k) to the post-processed sub-carrier symbols F(k).

21. Orthogonal frequency division multiplex demodulator (2) according to claim 20, wherein the fourth transforming means (15) for transforming the complex DFT output symbols Z(k) to post-processed sub-carrier symbols F(k) is adapted to perform the function:

$$F(k)=\frac{1}{2}\cdot\left[Z(k)+Z(N-k)^{*}\right]-\frac{1}{2}\cdot j\cdot\left[Z(k)-Z(N-k)^{*}\right]\cdot e^{-j\pi k/N}$$

with k=0...N-1.

22. Orthogonal frequency division multiplex demodulator (2) according to claim 20 or 21, wherein the DFT means (14) exhibits the functionality to perform a fast Fourier transformation (FFT).

23. Orthogonal frequency division multiplex demodulator (2) according to one of the claims 20 to 22, wherein the third transforming means (13) further comprises:
- de-multiplexer means (13a) for de-multiplexing the even and odd samples of the intermediate-frequency OFDM signal (f(n)) onto the real and imaginary parts of the complex DFT input symbols z(n)=x(n)+j*y(n) with x(n)=f(2n) and y(n)=f(2n+1),with n=0…N-1.

24. Orthogonal frequency division multiplex demodulator (2) according to one of the claims 20 to 23, wherein the DFT means (14) is adapted to perform the complex discrete Fourier transformation (DFT) of the complex input symbols z(n) into complex DFT output symbols Z(k)=X(k)+j*Y(k), with k=0…N-1, where X(k) and Y(k) are the spectra of the real sequences x(n) and y(n).

25. Orthogonal frequency division multiplex demodulator (2) according to one of the claims 20 to 24, wherein the fourth transforming means (15) further comprises:
- post-processing means (15a) for post-processing of the complex DFT output symbols Z(k), with k=1…N-1, to the post-processed sub-carrier symbols F(k)= X(k)+exp(-j*pi*k/N)*Y(k) of the intermediate-frequency OFDM signal (f(n));
-assigning means (15b) for assigning the post-processed sub-carrier symbols F(k) to an order for further processing.

26. Orthogonal frequency division multiplex demodulator (2) according to one of the claims 20 to 25, wherein the DFT means (14) and the second transforming means (15) are integrated in one device.